Kentucky. Dept. of Health

Mortality in Preschool Group
1932-39

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FOREWORD

This Study of Mortality in the age group one through four years was prepared solely for the purpose of establishing, as nearly as data at hand would permit, a critical and statistical analysis of the problem of preschool deaths in Kentucky. It is one of a series of four mortality reports, of purely statistical nature, on maternal, infant and preschool deaths.

The material here presented is primarly intended to be used by public health workers, physicians and interested laity for study and reference work alone. In no sense is it a description of the activities of the Division of Maternal and Child Health as they relate to the program directed toward reduction in morbidity and mortality in children of this specific age group.

F O R E W O R D

This study of Mortality in the age group one through four years was prepared solely for the purpose of establishing, as nearly as data at hand would permit, a critical and statistical analysis of the problem of preschool deaths in Kentucky. It is one of a series of four mortality reports, of purely statistical nature, on maternal, infant and preschool deaths.

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INTRODUCTION

The preschool group consists of children from one through four years of age. In Kentucky this group makes up approximately 9% of the State's total population and is an exceedingly important group when the future of the State is considered. Child hygiene is a great entering wedge for the entire public health program; and as a means of assuring a healthy generation it occupies a peculiar position in the public health field.

During the preschool years the diseases to which children are subject are different from those incident to the infant group. The importance of such communicable diseases as diphtheria, whooping cough, measles, and the like, shows the increasing influence of environment and association. This is the group most easily impressed by discordant and insanitary environment; therefore, the susceptibility to infectious diseases at this age is more acute than at any other age. But these are diseases which are especially amenable to preventive measures. This fact makes their study one of special importance from the standpoint of public health.

Incipient physical defects can more assuredly be corrected in the preschool years. It is also the period when nutritional needs require greatest attention for proper development. Therefore, as a means of assuring a generation free from disease, child hygiene is a most important part of any health program.

STATEMENT REGARDING THE STUDY

A statistical study of deaths among the preschool group in Kentucky has been made for the years 1932 through 1937 with certain supplementary material for 1938 and 1939. The number of deaths have been studied as to cause, race, sex and by rural and urban areas. An attempt has been made to determine:

(1) the main causes of death

(2) the effect that race and sex have on mortality and

(3) the differences in rates in the rural and urban areas.

The rates for Kentucky have been compared with those for the United States from 1926 - 1936.

Personnel of the W. P. A. Health Project in the State Department of Health aided in compiling and tabulating statistics used in this study.

RATES AND ESTIMATED POPULATION

To say that there are a certain number of deaths in the preschool group is not significant unless the population which was at risk is considered. The ratio of the annual number of deaths in the age group (1 through 4 years) to the population of the same age group gives the specific preschool mortality rate. The base of this rate is 100,000 specific population, which makes rates comparable from year to year and for different areas.

One of the most outstanding findings of all recent population studies is the fact that there is a decreasing percentage of total population

in the younger age groups. This is definitely true in the preschool group. In 1910, the population in the age group (1 through 4 years) made up 10.4% of the total population; in 1920, 9.7% of the total, and in 1930 it had decreased to 8.9%.

Obviously the 1930 population is not the correct number of persons in the preschool group for the subsequent years. Estimates of population for this age group are made for 1932 through 1939 on the basis of the increase of population between the 1920 and 1930 censuses. Also the assumption is made that immigration equals emigration. It is considered, however, that these crude estimates make a more useful basis for rates than the population of the last census (1930). The absolute increase was only 985 for the decade, but when certain population segregations are made, some startling differences are noted. The number of Negro children has decreased while the number of whites has increased. In the urban areas both the white and the Negro numbers show a decline.

COMPARISON OF KENTUCKY AND UNITED STATES RATES

Preschool mortality in Kentucky has been consistently higher than that for the United States since 1926. In general it may be said that the rates of decline have been practically the same for the United States as for Kentucky. The highest rate in the United States since 1926 was 650 deaths per 100,000 specific population in 1928, and the lowest, 394, in 1936 which is the last year for which the data were available. In Kentucky the highest rate was reported in 1926 -- 974 deaths per 100,000 specific population. There has been a consistent decline

in the Kentucky rates since 1934. The all time low was reached in 1938 -- 480 deaths per 100,000 population. The 1939 rate was only 382 deaths per 100,000 population but is not used in this comparison because it is based on a preliminary number of deaths.

TABLE I

PRESCHOOL MORTALITY IN U. S. (1926 - 1936) AND KENTUCKY (1926 - 1939)

RATES PER 100,000 SPECIFIC POPULATION

	UNITED STATES			KENTUCKY		
YEAR	ESTIMATED POPULATION	NO. DEATHS	RATES	ESTIMATED POPULATION	NO. DEATHS	RATES
1926	9,277,950	56,463	609	234,021	2,280	974
1927	9,271,866	45,216	488	234,117	1,614	689
1928	9,265,782	60,232	650	234,213	1,846	788
1929	9,259,698	57,142	617	234,309	2,049	874
1930	9,253,599	49,826	538	234,405	1,764	752
1931	9,247,515	45,663	494	234,501	1,648	703
1932	9,241,431	39,241	425	234,597	1,534	654
1933	9,235,347	41,015	444	234,693	1,441	614
1934	9,229,263	43,175	468	234,789	1,579	673
1935	9,223,179	36,807	399	234,885	1,408	599
1936	9,217,095	36,292	394	234,981	1,367	582
1937				235,077	1,247	530
1938				235,173	1,128	480
1939				235,269	898 [1]	382

[1] Preliminary vital statistics report

PRESCHOOL MORTALITY IN UNITED STATES AND KENTUCKY

1926 - 1938

RATES PER 100,000 SPECIFIC POPULATION

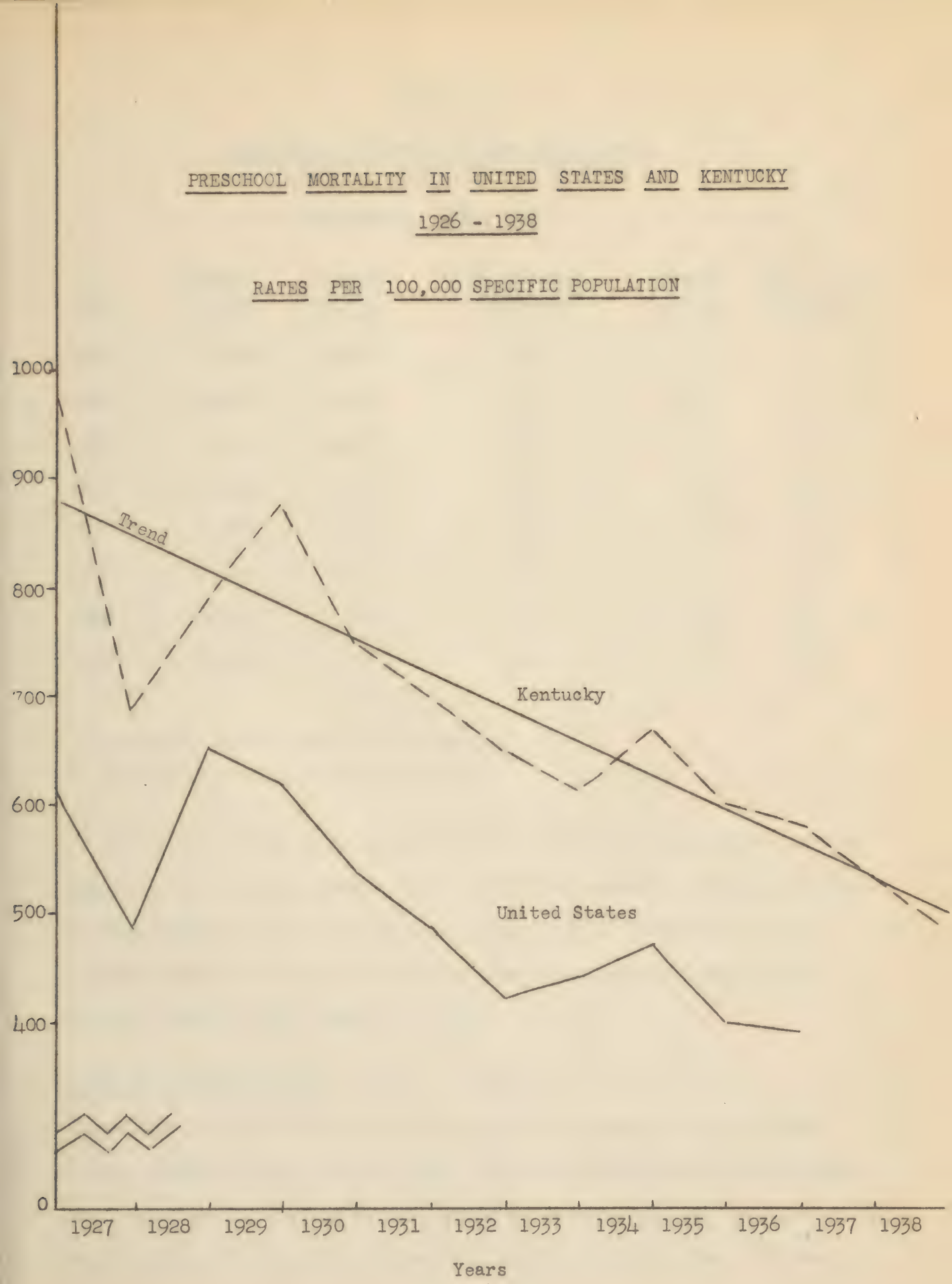


TABLE II

Comparison of Deaths in Age Group 1 - 4
With Those in Age Group 5 - 9 Years

Kentucky. 1932 - 1939

Year	Total Deaths [1]	Deaths 1 - 4	% of Total Deaths	Deaths 5 - 9 [1]	% of Total Deaths
1932	29,226	1,409	4.8	586	2.0
1933	28,528	1,340	4.7	556	1.9
1934	30,243	1,453	4.8	551	1.8
1935	29,569	1,369	4.6	523	1.8
1936	32,592	1,265	3.9	542	1.7
1937	31,032	1,144	3.7	463	1.5
1938	29,355	1,128 [1]	3.8	440	1.5
1939	29,393	898	3.0	350 [2]	1.2

[1] Bulletins, State Department of Health
[2] Preliminary vital statistics report

From the above table it is noted that the percentage which deaths in the age group (1 through 4 years) are of the total deaths in all age groups, is more than twice as great as in the group 5 - 9. After five years children have built up an immunity to the communicable diseases which are most fatal to the preschool group.

TREND OF MORTALITY RATES Table I, Graph I.

Inspection of Table I shows that the preschool mortality rate has made a very definite decline since 1926. Extensive programs of immunizations would show their value first by a decrease in morbidity and second by this decline in mortality. Since 1935 the observed rates have followed

closely to the calculated trend. Prior to that year there was a rather wide variation above and below the calculated trend.

The calculated decline has been from 870 to 500 deaths per 100,000 population. This trend calculated by least squares gives the value with the smallest standard deviation. The calculation is the sum of deviations made a minimum.

RACE

The number of deaths by white and Negro classification shows first that the Negro specific rates are consistently higher than the white (Table III). Among the whites the apparent decline in the number of deaths from 1932 to 1937 is probably not significant until 1937 when the odds against chance producing such a decrease from the mean of these years are 8 to 1.

The arithmetic mean of the number of Negro deaths for the period 1932-1937 is 116. Deviation from this mean was significantly large in 1935. For the other years tested, the odds against chance producing any given deviation is not in any instance greater than 6 to 1.

TABLE III

Preschool Mortality, Rates per 100,000 Specific Population;

White and Negro; Kentucky. 1932 - 1937

	Total	White	Negro
1932	654	641	836
1933	614	610	668
1934	672	660	857
1935	599	576	954
1936	582	573	707
1937	530	518	720

The composite Negro rate (1932-1936) is 192 per 100,000 specific population greater than the white. (612 white; 804 Negro)

When the rates are considered by the individual years, a slight decline is noted among the whites. In the Negro group there have been variations from year to year.

URBAN AND RURAL AREAS

TABLE IV

Urban and Rural Preschool Mortality - Rates per 100,000 Specific

Population - Kentucky. 1932 - 1937

	Total	Urban	Rural
1932	654	434	723
1933	614	459	664
1934	672	471	739
1935	599	471	643
1936	582	432	634
1937	530	413	572

The rural rates are higher than the urban for each year studied. The urban rates have remained fairly constant over the period of six years. More variability is observed in the rural rates. The fact that close association in the cities builds up an immunity to certain communicable diseases (i.e. diphtheria) and that the physician is more accessible in the cities are possible factors which make the urban rates lower than those in the rural areas.

When urban rates are considered by race classification certain differences are noted.

TABLE V

Death Rates in Preschool Age Group

In Urban Areas of Kentucky. By Race: 1932 - 1937

	White			Negro		
	Population	Deaths	Rate	Population	Deaths	Rate
1932	49,519	199	402	6,649	45	677
1933	50,539	227	448	6,752	36	533
1934	51,559	239	464	6,855	36	525
1935	52,579	221	420	6,958	59	848
1936	53,599	226	422	7,061	36	510
1937	54,619	217	397	7,164	38	530

The white rates are fairly consistent from year to year while the Negro rates show certain variations which may be within the limits of chance variation except in 1935.

TABLE VI

Death Rates in Preschool Age Group

In Rural Areas of Kentucky. By Race: 1932 - 1937

	White			Negro		
	Population	Deaths	Rate	Population	Deaths	Rate
1932	170,279	1,210	711	7,960	80	1,005
1933	169,499	1,115	658	7,732	63	815
1934	168,719	1,214	720	7,504	90	1,199
1935	167,939	1,048	624	7,276	80	1,100
1936	167,159	1,039	622	7,048	66	936
1937	166,379	927	557	6,820	65	953

The Negro rates in the rural areas are the highest of any observed. The low economic status of this particular group probably has more weight in the existence of these rates than any other factor.

TABLE VII

Death Rates by Cause in Preschool Age Group
Rate per 100,000 Estimated Specific Population By Race:
Kentucky, 1932 - 1936

	Total	White	Negro
Diarrhea	142	140	177
Pneumonia	102	97	171
Diphtheria	73	76	38
Whooping Cough	34	32	56
Influenza	29	28	48
Dysentery	29	29	33
Accidental Burns	20	19	28
Tuberculosis	19	17	50
Meningitis	17	17	18
Measles	14	15	10
Scarlet Fever	11	12	1
Congenital Debility	7	7	14
Nephritis	7	7	8
Auto Accidents	6	6	4
Infantile Paralysis	6	6	3
Typhoid Fever	6	5	19
Encephalitis	5	5	4
Diseases of Pharynx and Tonsils	5	5	5
Appendicitis	4	4	4
Diseases of Heart	4	4	3
Congenital Malformations	3	3	8
Cerebral Hemorrhage	3	3	3
Accidental Drowning	3	3	1
Septicemia	3	3	0
All Other	70	68	98
TOTAL	624	612	804

CAUSE OF DEATH

For the years 1932 through 1936, the main cause of death among the preschool group was "diarrhea and enteritis". The rate at which children died from this cause within the period of study was 142 for every 100,000 children from the ages 1 through 4 years. The number of deaths represents about 23% of the total number of preschool deaths from all causes. When the number of deaths from dysentery is added to those reported as having died from diarrhea the total is 2,019 or 27.6% of the total preschool deaths for this period.

Pneumonia is the cause of the second largest number of deaths, or 16% of the total deaths. The mortality rate of pneumonia was 102 per 100,000 specific population. (Table VIII)

Diphtheria claimed 862 lives, or 12% of the total number of deaths. For every 100,000 children 1 through 4 years of age 73 died from diphtheria.

The three above causes, "diarrhea and enteritis", pneumonia and diphtheria, were responsible for more than 50% of the preschool deaths during the period 1932 - 1936. This fact alone well defines work to be done in preventing deaths in the preschool group.

TABLE VIII

Number of Preschool Deaths From Each Specific Cause and Percentage of The Total Preschool Deaths - Kentucky

1932 - 1936 (Composite)

	Number of Deaths	Percent of Total
Diarrhea	1,674	22.9
Pneumonia	1,194	16.3
Diphtheria	862	11.8
Whooping Cough	397	5.4
Influenza	344	4.7
Dysentery	345	4.7
Accidental Burns	233	3.2
Tuberculosis	221	3.0
Meningitis	205	2.8
Measles	170	2.3
Scarlet Fever	128	1.7
Congenital Debility	86	1.2
Nephritis	81	1.1
Auto Accidents	72	1.0
Infantile Paralysis	66	.9
Typhoid	66	.9
Encephalitis	62	.8
Diseases of Pharynx and Tonsils	60	.8
Appendicitis	53	.7
Diseases of Heart	52	.7
Congenital Malformations	37	.5
Cerebral Hemorrhage	35	.5
Accidental Drowning	33	.4
Septicemia	31	.4
All Other	822	11.3
TOTAL	7,329	100.0

CAUSE OF DEATH BY RACE

In considering the causes of death among the preschool group by race for 1932 - 1936 the following differences are noted. "Diarrhea and enteritis" is the main cause of death both among the white and the Negroes, but the rate of dying is greater among the Negroes. (177 deaths per 100,000 specific population for Negroes and 140, white)

The same may be said of pneumonia as the second cause of deaths. (Negro, 171 deaths per 100,000 specific population, white, 102)

Diphtheria is the next leading cause of death. The rate of dying from diphtheria, however, is twice as high in the white race as in the Negro. (76 per 100,000 for the white, 38, Negro)

Whooping cough on the other hand again shows a higher rate of death in the colored group. Both whooping cough and influenza rank above diphtheria as a cause of death among the Negroes.

The reported mortality rate from tuberculosis is approximately three times greater among the Negroes.

For every 100,000 white children from 1 through 4 years of age, 68 died from causes other than the 24 specific ones listed or from ill defined causes, in the period 1932 - 1936. If 100,000 Negro children be considered, 98 of them died from causes other than those given. The higher rate in the Negro group is an indication of less medical service to this group. If a child were attended by a physician the cause of death would in most cases be specifically defined.

DIARRHEA AND ENTERITIS [1]

TABLE IX

Deaths From Diarrhea and Enteritis in Preschool Group:
Rates Per 100,000 Estimated Population
Kentucky and United States (1926 - 1939)

	United States		Kentucky	
Year	Number	Rate	Number	Rate
1926	8,869	95.6	494	211.1
1927	7,663	82.6	356	152.1
1928	8,692	93.8	441	188.3
1929	7,401	79.9	393	167.7
1930	8,505	91.9	454	193.7
1931	6,155	66.6	384	163.8
1932	4,845	52.4	363	155.0
1933	5,804	62.8	325	138.0
1934	5,603	60.7	361	154.0
1935	3,641	39.5	264	112.0
1936	4,775	51.8	361	154.0
1937			246	105.0
1938			271	115.0
1939			200 [2]	85.0

The preschool mortality rate from diarrhea is about three times greater in Kentucky than in the United States. It is noted that there has been a decided decline in the United States rate while the rate in Kentucky only suggests a slight decline.

[1] Deaths from dysentery are not included.
[2] Preliminary vital statistics records.

TABLE X

Deaths From Diarrhea and Enteritis in Age Group (1 - 4)
Percentage of Total Preschool Deaths - Kentucky
1932 - 1939

	Deaths	Total Preschool Deaths	Percent of Preschool Total Deaths
1932	363	1,534	24
1933	325	1,441	23
1934	361	1,579	23
1935	264	1,408	19
1936	361	1,367	26
1937	246	1,247	20
1938	271	1,128	24
1939	200 [1]	898 [1]	22

"Diarrhea and enteritis" continues to be the chief cause of death among children under 5 years of age in Kentucky. Approximately one-fourth of all the deaths from this cause occur within the age group 1 through 4 years.

Each year for the past ten years diarrheal diseases have taken the lives of more children under five years of age than diphtheria, scarlet fever, measles, whooping cough, epidemic meningitis, and infantile paralysis combined. [2]

When the composite number of deaths from diarrhea and enteritis in the age group (1 through 4 years) is considered, it is found to be 23% of the total preschool deaths, 1932 - 1936.

[1] Preliminary vital statistics report.

[2] Caudill, F. W., M.D., "Diarrhea and Enteritis in Children in Kentucky", State Bulletin, June 1939.

Teaching the fundamental rules of hygiene and cleanliness to the ignorant, careless, and poverty stricken and guiding them in feeding are the best means of reducing the incidence of diarrhea. The rate of dying from this cause has remained exceptionally high despite the simple methods which are most effective in the prevention of these deaths.

Because the measures which may be employed in preventing this disease are almost entirely educational, the waste of human life from diarrhea and enteritis defines a public health problem of the first magnitude.

TABLE XI

Deaths From Diarrhea in Preschool Group
Rates by Rural and Urban Areas, By Race
Rates per 100,000 Specific Population - Kentucky. (1932-1936 Composite)

	Deaths	Population 1 - 4 (Composite 1932-1936 Est.)	Rate per 100,000 Population
Rural	1,427	881,115	161.9
White	1,338	843,595	158.6
Negro	89	37,520	237.2
Urban	247	292,070	84.6
White	207	257,795	80.3
Negro	40	34,275	116.7

The mortality from diarrhea is greater in the rural areas than in the urbanized centers. Because of living conditions in rural areas, it is natural to suppose the incidence would be greater, and it follows because there are more cases there are more deaths. There is a lack of refrigeration for keeping foods fresh in the country. Homes are not

equipped with means of disposing of human excreta in a sanitary manner. Screening for preventing flies is wholly lacking or not complete. Physicians are also less available in the rural areas.

The specific mortality rate from diarrhea is greater among Negroes than among white; 177 deaths per 100,000 population for the Negro in comparison with the white rate of 140. The rural Negro rate is the highest of any rates observed, and is 49% higher than the rural white rate. The urban Negro rate is 45% higher than the urban white rate. It is likely that the difference in these rates is due to the more insanitary living conditions among the Negroes.

PNEUMONIA

TABLE XII

Deaths from Pneumonia in Preschool Group
Rates per 100,000 Estimated Population - Kentucky and United States
(1926 - 1939)

	United States		Kentucky	
Year	Number	Rate	Number	Rate
1926	13,026	140.4	319	136.3
1927	9,081	97.9	191	81.6
1928	11,424	123.3	266	113.6
1929	10,211	110.3	246	105.0
1930	8,673	93.7	206	87.9
1931	8,231	89.0	204	87.0
1932	7,013	75.9	248	106.0
1933	6,716	72.7	201	86.0
1934	7,830	84.8	234	100.0
1935	7,116	77.2	247	105.0
1936	7,483	81.2	264	112.0
1937			236	100.0
1938			170	72.0
1939			137	59.1

The mortality rate of pneumonia in Kentucky was lower than that for the United States from 1926 to 1931. Since that year there has been a higher rate in Kentucky.

TABLE XIII

Pneumonia Deaths in the Preschool Group
Percentage of Total Preschool Deaths - Kentucky
1932 - 1939

Year	Total Deaths	Total Preschool Deaths	% of Total
1932	248	1,534	16
1933	201	1,441	14
1934	234	1,579	15
1935	247	1,408	18
1936	264	1,367	19
1937	236	1,247	19
1938	170	1,128	15
1939	137	898	15

From previous discussion it is noted that pneumonia is one of the leading causes of death. There was no significant decline in the deaths from this cause up to 1938. Since 1932 it has been the cause of approximately one-sixth of the total preschool deaths.

The proportionate mortality of pneumonia in this age group has ranged from 9% of the total pneumonia deaths for all ages in 1932 to 7.6% in 1938. This has not been a steady decline, however. In 1934 and 1935, 10% of the deaths from pneumonia were among children 1 through 4 years.

It is with potential pneumonia that the public health service may function most effectively. Proper nutrition of the infant will be some defense against pneumonia in that child. Proper care of whooping cough and measles cases will ward off secondary pneumonias.

There appears to be but little difference in the incidence of pneumonia in rural and urban areas. The rate of pneumonia deaths is higher among the Negroes. This is probably true not because of a difference in the way it affects the races but because the economic level of a family is an influence. Poverty and ignorance may operate indirectly as factors which decrease the resistance of the child and make him more susceptible to pneumonia.

DIPHTHERIA

TABLE XIV

Deaths From Diphtheria in Preschool Group
Rates per 100,000 Specific Population - Kentucky and United States
1926 - 1939

	United States		Kentucky	
Year	Number	Rate	Number	Rate
1926	4,051	43.7	180	76.9
1927	4,300	46.4	153	65.4
1928	4,341	46.8	163	69.6
1929	3,982	43.0	151	64.4
1930	2,963	32.0	113	48.2
1931	2,990	32.3	212	90.4
1932	2,725	29.5	202	86.0
1933	2,583	28.0	222	95.0
1934	2,232	24.2	193	82.0
1935	2,038	22.1	153	65.0
1936	1,636	17.7	91	39.0
1937			77	33.0
1938			90	38.0
1939			56	23.8

The preschool death rate from diphtheria has shown a very definite downward trend since 1934. The years subsequent to this particular year reflect the extensive immunization program of preschool children. For the country as a whole, there has been a consistent decline since 1928. Although the decline in Kentucky has been more pronounced than in the United States for the last six years, the State rate is still more than double that for the country as a whole.

TABLE XV

Deaths from Diphtheria in Age Group (1 - 4)
Percentage of Total Preschool Deaths - Kentucky
1932 - 1939

Year	Deaths	Total Preschool Deaths	% of Total
1932	203	1,534	13
1933	222	1,441	15
1934	193	1,579	12
1935	153	1,408	11
1936	91	1,367	7
1937	77	1,247	6
1938	90	1,128	8
1939	56	898	6

Deaths from diphtheria have comprised between 6 and 15% of the total preschool deaths since 1932. It ranks next to "diarrhea and enteritis" and pneumonia as a cause of death.

Case fatality of diphtheria is highest among children under 5 years of age. Since 1932 approximately 14% of the deaths from diphtheria were in the infant group although little more than 1% of the cases reported

were in this group. In the group 1 through 4 years, one-third of the cases occurred and more than one-half of the total deaths.

The rate of dying from diphtheria is twice as high in the white race as in the Negro race. For the five year period, 1932-1936, the white rate was 76 deaths per 100,000 specific population, and 38 per 100,000 for the Negro rate. The prevalence of the disease is much less among the Negro than among the white.[1]

Only speculations as to the reason for this can be made. Some theories have been advanced of there being a physiological reason. More generally, however, it is believed that because of the closer living conditions in the colored race due to economic status a greater immunity is built up.

TABLE XVI

Deaths From Diphtheria In Preschool Group
Rates by Rural and Urban Areas, By Race Per 100,000 Specific Population
Kentucky 1932 - 1936

	Deaths	Population 1 - 4 (Composite 1932-1936 Est.)	Rate Per 100,000 Population
Rural	732	881,115	83
White	714	843,595	84
Negro	18	37,520	48
Urban	130	292,070	44
White	120	257,795	46
Negro	10	34,275	29

[1]Rosenau, "Preventive Medicine and Hygiene", page 188

The death rate from diphtheria is approximately twice as great in the rural areas as in the cities. The white rate in rural sections is the highest of any specific rates observed.

In the urban population, frequent temporary carrier states are established, perhaps with organisms at a low level of virulence; as a consequence of this a certain amount of diphtheria immunity and antitoxin production results. Many studies have been made to verify the greater susceptibility among the rural population.[1]

Public health workers generally agree that from 90 to 95% of children given two doses of toxoid are made immune for life.[2] The permanence of the immunity, however, seems not entirely the result of toxoid; it depends, to some extent, on the fact that the child later receives additional antigen.

There is considerable evidence that with the marked reduction in diphtheria there is a parallel reduction in the carriers of the virulent organism which may eventually reach the point where there is insufficient stimulus resulting from subclinical contact with the organism to maintain immunity.[3] If this is definitely established, additional measures may have to be administered to provide stimulus for protection.

[1] Zinnser, Enders and Fothergill, "Immunity Principles and Application in Medicine and Public Health", Page 513.

[2] Mustard, Harry S., "Rural Health Practice", Page 327.

[3] Stebbins, Ernest L., "Communicable Disease and the School", New York Journal of Medicine, 39: 2174, 1939.

At present, however, protection against diphtheria, through the medium of immunization, is one of the health measures of proven and recognized value in the work of safeguarding the health of children. Because this disease is transmitted from one person to another, the control and prevention is of concern to the community as well as to the individual. This makes it of particular interest from the standpoint of public health. Immunization of a certain portion of the susceptible population of a community, however, affords protection against epidemic outbreaks, but does not furnish protection to the unimmunized individual.

Young infants are generally immune to diphtheria. This immunity is passive, antitoxin having passed the placental barrier from mother to fetus. The presence of this natural antitoxin lasts for approximately six months. The greatest number of susceptibles occur between the ages of ten months and five years, and it is during this period that diphtheria is most common. After five years the percentage of those with natural immunity increases rapidly.

It is an accepted fact that at least 65% of the preschool group must have received an administration of antigen in order to make a community safe from diphtheria. Only twelve of the 86 counties with organized county health departments have 65% or more of their preschool population, as of January 1, 1940, innoculated against diphtheria.[1] For the 86 counties only 21% of the children 1 through 4 years of age have a potential immunity to the disease, because of having been innoculated at some time in their lives. It is well to note that in those counties

[1]State Department of Health Bulletin, February, 1940.

in which there are cities the percentage having received artificial immunity is no greater than in the rural counties. This is true despite the fact that there is greater facility in administering preventive measures in the urban areas.

MEASLES

TABLE XVII

Deaths From Measles in the Preschool Group
Rates Per 100,000 Estimated Population - Kentucky and United States
1926 - 1939

	United States		Kentucky	
Year	Number	Rate	Number	Rate
1926	4,589	49.5	216	92.3
1927	2,207	23.8	71	30.3
1928	2,997	32.3	88	37.6
1929	1,488	16.1	26	11.1
1930	1,931	20.9	68	29.0
1931	1,804	19.5	90	38.4
1932	889	9.6	14	6.0
1933	1,358	14.7	8	3.0
1934	3,023	32.8	63	26.0
1935	1,642	17.8	70	30.0
1936	564	6.1	16	7.0
1937			29	12.0
1938			30	13.0
1939			11	4.7

In observing any set of death rates of measles, cycles of the disease are noted. The disease will appear in a community every few years or as soon as there are sufficient susceptibles. Variation in the measles morbidity rates account for the diversity in the mortality rates from year to year.

While approximately one-third of all measles cases are in the preschool group, more than 50% of the deaths occur in this group. According to the experience of Aberdeen[1] a larger number are attacked in the second than in the first year of life. The attack rate is about equal from the second to the seventh year. There is a diminishing fatality of measles with each increasing year of life.

Experimental and clinical work indicates that measles may be prevented or modified by conveying passive immunity to the child during the period of incubation. Whole blood, pooled adult serum and convalescent serum may be used for this purpose. These materials, however, are difficult to obtain in sufficient amounts for widespread use.

The potency of either convalescent serum or adult blood serum cannot be sufficiently determined to foretell the extent of modification or prevention of measles. There is also a possibility of transmitting syphilis by either of these immunizing agents.

Research by McKhann in connection with the globulin content of the placenta and its contained blood, has resulted in the development of a purchasable product that is quite effective in the prophylaxis of

[1] Newsholme, "Vital Statistics", Page 416

measles.[1] The immunity conferred by the placental extract is transitory, lasting only two weeks. This is sufficient length of time to modify the average case of measles. Modification, moreover, is the most desirable end to be sought since this allows the individual to have a very mild case of measles which confers (in the majority of cases) an active lasting immunity. If an attack is prevented altogether the immunity is gone by the end of the second or, at most, the third week and the individual is again susceptible. Because of the cost of the placental extract and because it must be given within a specific stage of the disease, it is used only in a selected group, the undernourished or chronically diseased persons under 5 years of age. Even though its use is very limited, it is the first public health gesture in connection with the prevention of measles by immunization.

TUBERCULOSIS

Death rates from tuberculosis have remained fairly constant since 1932. The preschool child or the infant who is exposed intimately and more or less continuously to tuberculosis will be infected in almost every instance. The practical importance is that the child should not be allowed to remain in the home with an open case of tuberculosis. One or the other, preferably the case, should be removed.

[1] Mustard, H. S., "Rural Health Practice", Page 331

TABLE XVIII

Deaths From Tuberculosis in Age Group (1 - 4)
Percentage of Total Preschool Deaths - Kentucky
1932 - 1939

Year	Deaths	Total Preschool Deaths	% of Total
1932	43	1,534	2.8
1933	48	1,441	3.3
1934	52	1,579	3.3
1935	41	1,408	2.9
1936	37	1,367	2.7
1937	42	1,247	3.4
1938	44	1,128	3.9
1939	28	898	3.1

Although the number of deaths from tuberculosis in this age group forms a very small percentage of the total number of deaths from tuberculosis, it is not a negligible portion of all preschool deaths. A most discouraging fact is the constancy of the rate of deaths from this cause.

The rate of dying is approximately three times greater among the Negroes than among the white.

The urban rate of tuberculosis is 22 deaths per 100,000 specific population as compared with 18 in the rural areas. A possible explanation of the higher rate in the cities is that the three (3) tuberculosis sanitoria are in cities. (Hospital facilities for the care and treatment of tuberculosis patients are wholly inadequate in the State.[1])

[1] Medical Economics Report, Bulletin of State Department of Health, August, 1939, Page 13.

Chief among the factors responsible for the reduction in the total tuberculosis death rate is health education. Until mothers are educated as to the importance of early diagnosis of this disease in preschool children and the proper care of an infected individual, the death rate for this particular age group will not decline.

ACCIDENTAL BURNS

The number of deaths from accidental burns has remained high. Deaths from this cause made up 3.2% of the total preschool deaths during the period 1932-1936.

TABLE XVIV

Deaths From Accidental Burns in the Preschool Group
Rate Per 100,000 Specific Population: Kentucky, 1932 - 1939

Year	Number Deaths	Rate
1932	51	22
1933	47	20
1934	45	19
1935	50	21
1936	40	17
1937	48	20
1938	54	23
1939	57	24

The rate of dying from accidental burns is approximately 50% greater among the colored race. For the period 1932-1936, rural rates (white, 21.6 per 100,000 population, Negro 34.6) are higher than the urban rates (white, 11.3; Negro 23.3).

According to the statistical reports from the Metropolitan Life Insurance Company,[1] the rate of dying from burns during the period 1931-1935 in the United States for the age group 1 through 4 years was as follows: (Death rates given per 100,000 population)

	Male	Female
White	11.7	13.9
Colored	16.1	22.6

As in Kentucky, it is noted that the Negro rates are higher than the white. Among the whites the rates in this age group are the highest of any age group. Among the Negroes, however, in the group between 65 and 74 the rate is highest and the preschool rate next. Unsafe housing is partially responsible for this unfavorable position of the colored population.

These statistical reports[1] show that in early childhood, i.e., under five years, scalds are the leading type of accidental burns.

There are definite and characteristic differences, according to the age of the child, in the circumstances commonly surrounding the fatalities of scalds. The child when first starting to walk will grasp everything in sight, either to steady his walk or to satisfy his curiosity; the result is that more than half of the deaths by scalding during the first two years of life were caused by upsetting liquids rather than falling into them. Among slightly older children whose play becomes more vigorous there is an increase in the number of deaths caused by falls into containers of hot liquids.

[1]Statistical Bulletin, Metropolitan Life Insurance Company, September, 1936, Vol. 17, No. 9; September, 1938, Vol. 19, No. 9

This unfortunate record of statistics reminds us very vividly that parents, particularly those with children from 1 to 4 years, should be made aware of the grave danger of serious or fatal injury to which their children are exposed from burns in their own home. Many parents do not fully realize the danger of matches in the hands of young children. It should be impressed on them that inflammable fluids, such as gasoline, should not be used in cleaning; that handles of pots and pans should be turned toward the back of the stove; that protective screens should be used in front of open fires.

The reduction of deaths and injuries from accidental burns is, therefore, primarily a problem of educating the parents. For this reason it is of particular importance to the public health worker.

OTHER CAUSES OF DEATH

Discussion of the most important causes of death in the preschool group or causes where public health measures are particularly effective is included in this paper. The rank of the other causes is observed in Tables XIII and XIV.

SEX

Sex does not play a very important part in the occurrence of acute communicable diseases.

According to the 1930 Census report, 50.9% of the population (1 through 4 years) was male and 49.1% female. On this basis the number of deaths by sex was tested for significance. It was found that there were significantly more female deaths from whooping cough than male deaths. This

is in keeping with the reference on attack rates among the male and female.[1] "In a few diseases the attack rates are consistently and significantly higher in one sex than in the other. In whooping cough females are attacked at a higher rate than males."

Deaths from auto accidents are significantly more among the males. A possible explanation is that boys are more apt to play in dangerous places.

HEALTH PROTECTION IN THE PRESCHOOL GROUP[2]

The preventive measures of proven and recognized value in the work of safeguarding the health of children in the preschool group were outlined at the White House Conference on Child Health and Protection in 1930. First is the periodic health examination. That is, children have been taken to the physician not because of illness, but for health advice and attention. A dental examination for advice and attention is a second preventive measure, considered in the survey. While the health examination is a general preventive measure, there are two others which are of specific nature and of proven value, vaccination against smallpox and immunization against diphtheria.

Educating parents as to the effectiveness of such preventive measures in the preschool age group constitutes one of the most important problems in the field of public health.

[1] Mustard, H, S., "Rural Health Practice", Page 436.

[2] "Health Protection for the Preschool Child", National Survey of the Use of Preventive Medical and Dental Service for Children Under Six, White House Conference on Child Health and Protection.

TABLE XX

Preschool Death Rates Per 100,000 Specific Population by Kentucky Public Health Districts (1932-1936) Composite Rates

District	Rates		
	Total	White	Negro
1. Big Sandy	595	596	478
2. Cave Area	644	628	836
3. Central	519	503	660
4. Green River	758	752	807
5. Jackson Purchase	781	727	1,307
6. Kentucky River	791	789	833
7. North Central	484	465	706
8. South Central	586	579	744
State	624	612	804

Kentucky is divided into 8 public health educational districts. Because these districts are made up of counties grouped according to their geographical positions, certain differences in the mortality rates in the State may be studied.

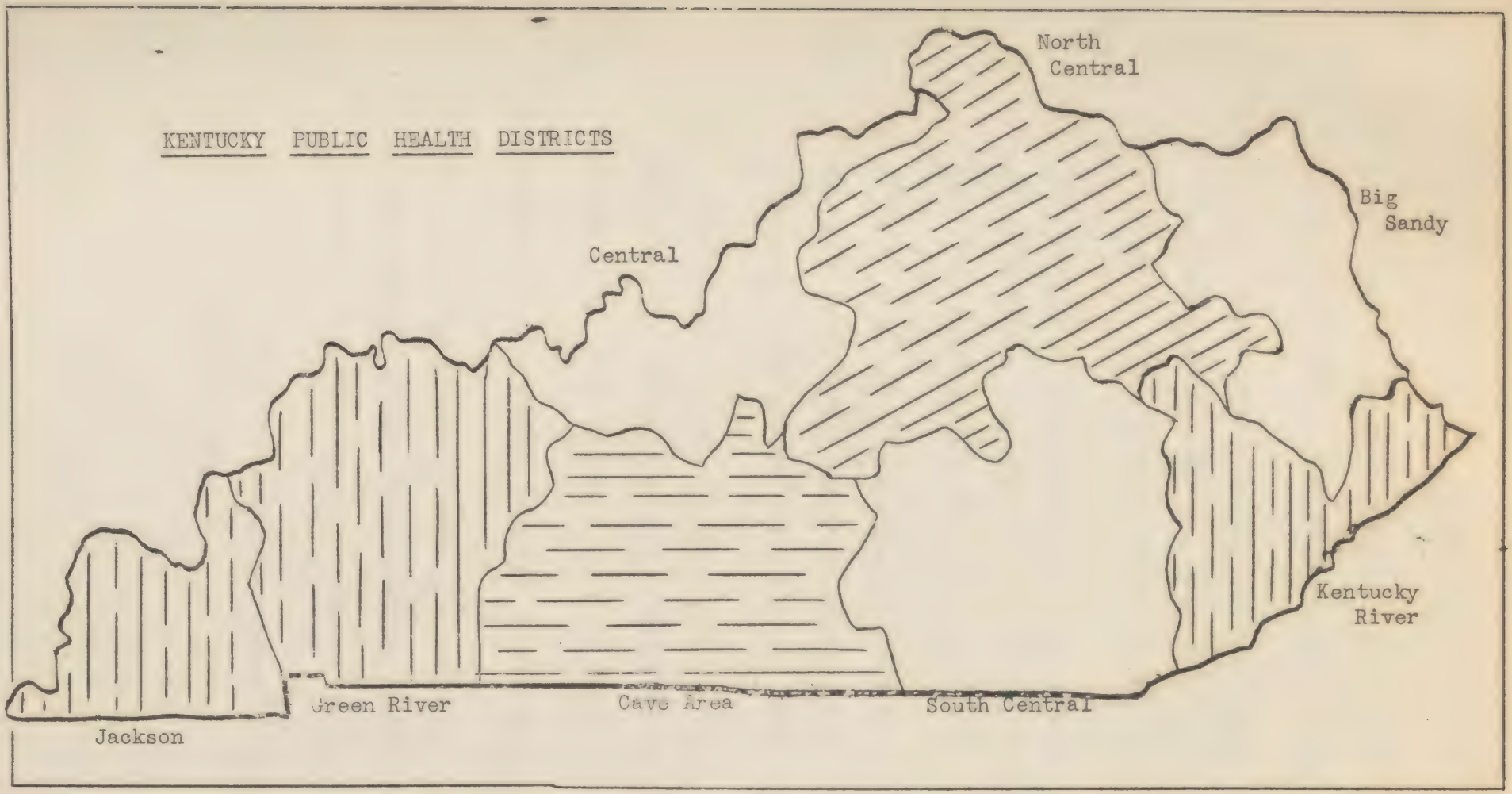
The preschool mortality rates by districts are in direct relationship to the economic status of the district. The Kentucky River area made up of certain mountainous counties has the lowest economic status of the State according to the measure of annual per capita income.[1] Also there are fewest available physicians of any district in the State. This district has the highest preschool death rate in the State.

[1]Medical Economics Report, Bulletin of State Department of Health, August, 1939.

Jackson Purchase District in western Kentucky also has counties with a low economic status. Correspondingly there is a high preschool mortality rate.

The Central and North Central Districts, with larger proportions of urban population than any other districts, have the highest per capita income and the lowest preschool mortality.

In only one district, Big Sandy Area, is the Negro rate lower than the white. The highest Negro rate and also the highest of any rates observed by the districts is the Negro preschool mortality rate of the Jackson Purchase District.



PRESCHOOL MORTALITY; RATES PER 100,000 SPECIFIC POPULATION 1932 - 1936 INCLUSIVE

400 - 499
500 - 599
600 - 699
700 - 799

SUMMARY

The term "preschool population" used in this study is defined to be that group of children one through four years of age.

1. Preschool mortality in Kentucky has been higher than that for the United States since 1926. The rate of decline has been practically the same for both the State and the country as a whole.

2. When considered by race, the Negro mortality rate in Kentucky is about 31% higher than the white for the period 1932-1936. A slight decline is noted in the white rates since 1932.

3. The rural rates are higher than the urban for each year studied. The urban rates have remained fairly constant since 1932. The Negro rural rates are the highest of any rates considered.

4. The main cause of death among the preschool group is "diarrhea and enteritis" which disease is responsible for approximately one-fourth of the total deaths in this age group.

5. Pneumonia and diphtheria rank next to diarrhea as causes of death.

6. The rate of dying from "diarrhea and enteritis" and pneumonia is greater among the Negro than the white. Diphtheria, on the other hand has a rate twice as high in the white race as in the Negro.

7. Both whooping cough and influenza rank above diphtheria as a cause of death among the Negroes.

8. The mortality rate from tuberculosis is approximately three times greater among the Negroes.

9. Mere "maleness" and "femaleness" does not play an important part in the occurrence of communicable diseases. However, it was found that there were significantly more female deaths from whooping cough than male deaths.

CONCLUSIONS

Child hygiene is a great entering wedge for the entire public health program; as a means of assuring a healthy generation it occupies a peculiar position in the public health field. Problems of preventing mortality among the preschool group are definitely defined. First it may be noted that the majority of deaths in this group are preventable.

Generally speaking the preschool mortality is in direct relationship to economic status. Much could be done through educating the parents as to the means of preventing disease, injury and death in the preschool group.

R E F E R E N C E S

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4. Whipple, G. C., "Vital Statistics"

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6. U. S. Mortality Statistics - Census Bureau